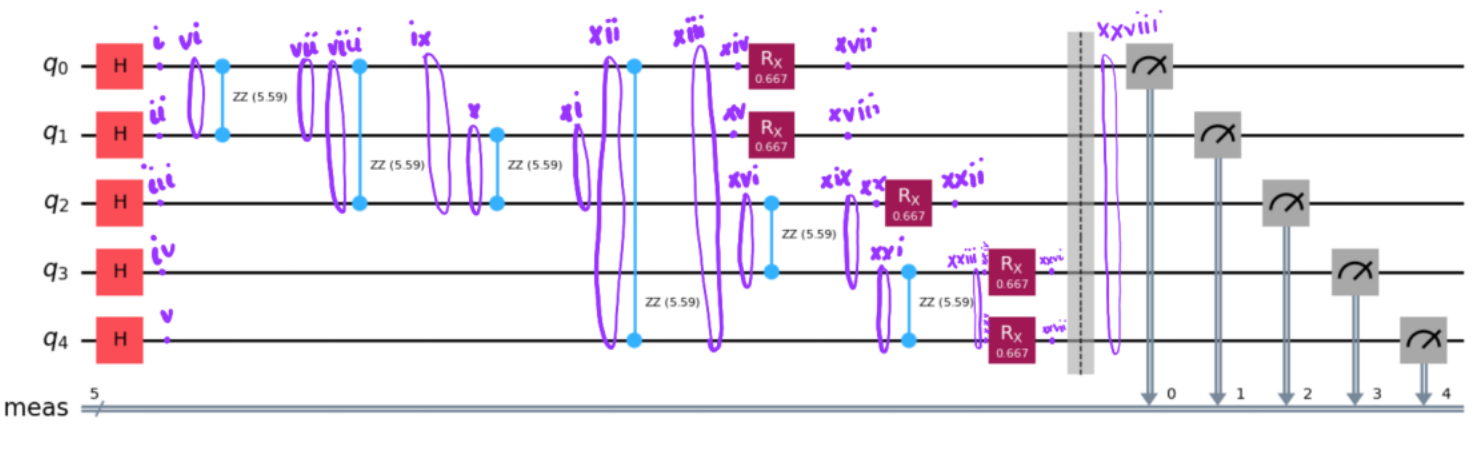


$i = H|0\rangle = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$ $\quad ii = H|0\rangle = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$ $\quad iii = H|0\rangle = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$

$iv = H|0\rangle = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$ $\quad v = H|0\rangle = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$

$$vi = i \otimes ii = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \otimes \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} = \begin{bmatrix} \frac{1}{\sqrt{2}} \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \\ \frac{1}{\sqrt{2}} \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \end{bmatrix} = \begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} \end{bmatrix}$$

$$vii = \frac{1}{2} \begin{bmatrix} e^{-i2.795} \\ e^{i2.795} \\ e^{i2.795} \\ e^{-i2.795} \end{bmatrix}$$

$$= \frac{1}{2} \begin{bmatrix} -0.94 - 0.342i \\ -0.94 + 0.342i \\ -0.94 + 0.342i \\ -0.94 - 0.342i \end{bmatrix}$$

$$viii = ii \otimes vii$$

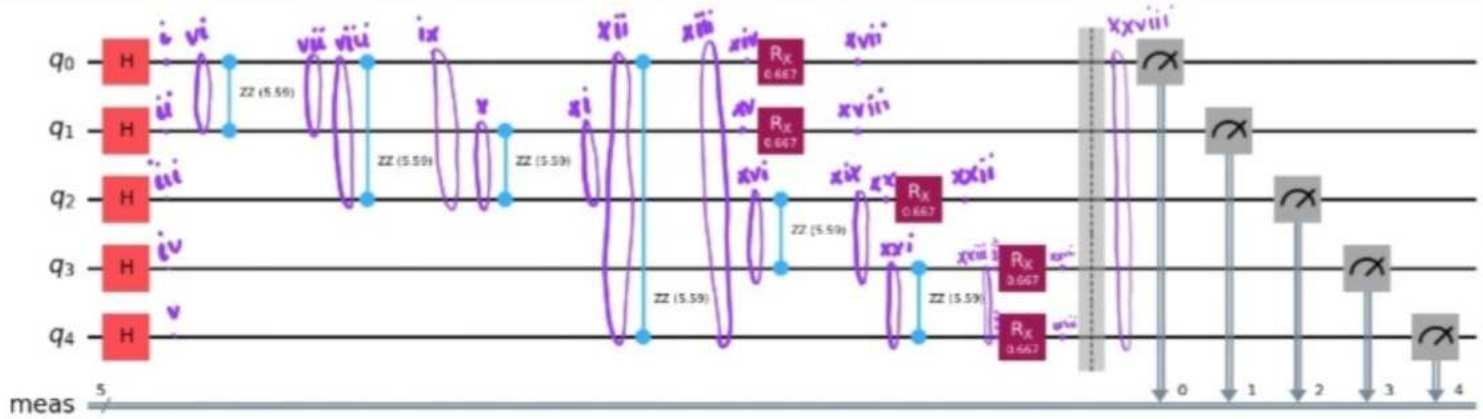
$$= \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \otimes \frac{1}{2} \begin{bmatrix} e^{-i2.795} \\ e^{i2.795} \\ e^{i2.795} \\ e^{-i2.795} \end{bmatrix}$$

$$= \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i2.795} \\ e^{-i2.795} \\ e^{i2.795} \\ e^{i2.795} \\ e^{i2.795} \\ e^{i2.795} \\ e^{-i2.795} \\ e^{-i2.795} \end{bmatrix}$$

$$ix = \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i(2)(2.795)} \\ \vdots \\ e^{i(2)(2.795)} \\ e^{i(2)(2.795)} \\ \vdots \\ e^{-i(2)(2.795)} \end{bmatrix} = \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i(5.59)} \\ \vdots \\ e^{i(5.59)} \\ e^{i(5.59)} \\ \vdots \\ e^{-i(5.59)} \end{bmatrix}$$

x = same as ix $= \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i(5.59)} \\ \vdots \\ e^{i(5.59)} \\ e^{i(5.59)} \\ \vdots \\ e^{-i(5.59)} \end{bmatrix}$

$$xi = \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i(8.385)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{-i(8.385)} \end{bmatrix}$$

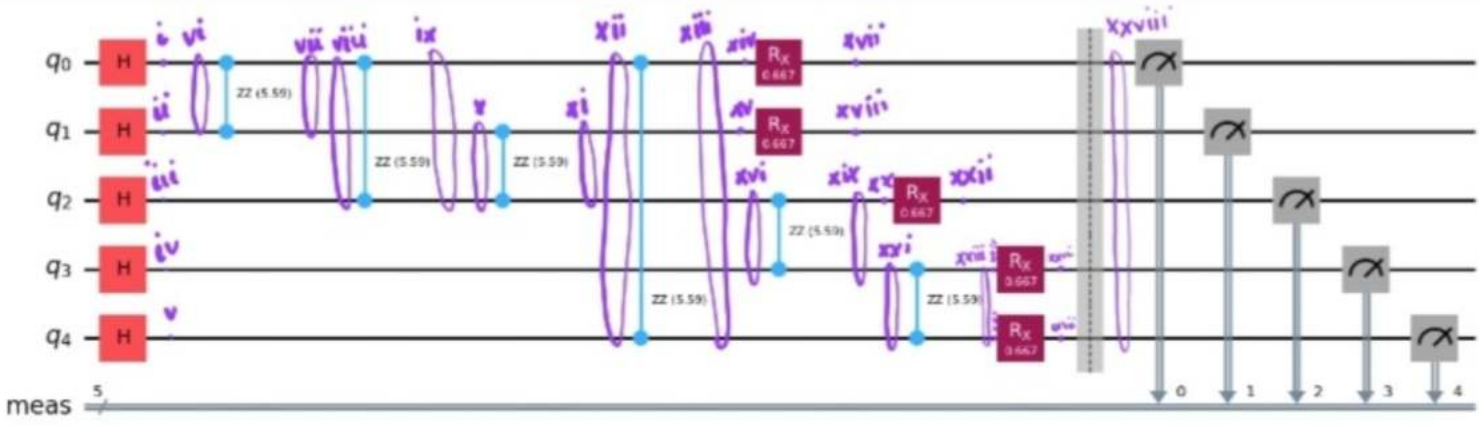


$$XII = XI \otimes (IV \otimes V)$$

$$= \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i(8.385)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{-i(8.385)} \end{bmatrix} \otimes \left(\begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \otimes \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \right) = \frac{1}{2\sqrt{2}} \begin{bmatrix} e^{-i(8.385)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{-i(8.385)} \end{bmatrix} \otimes \frac{1}{2} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$= \frac{1}{4\sqrt{2}} \begin{bmatrix} e^{-i(8.385)} \\ e^{-i(8.385)} \\ e^{-i(8.385)} \\ e^{-i(8.385)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{i(2.795)} \\ e^{-i(8.385)} \\ e^{-i(8.385)} \\ e^{-i(8.385)} \\ e^{-i(8.385)} \end{bmatrix}$$

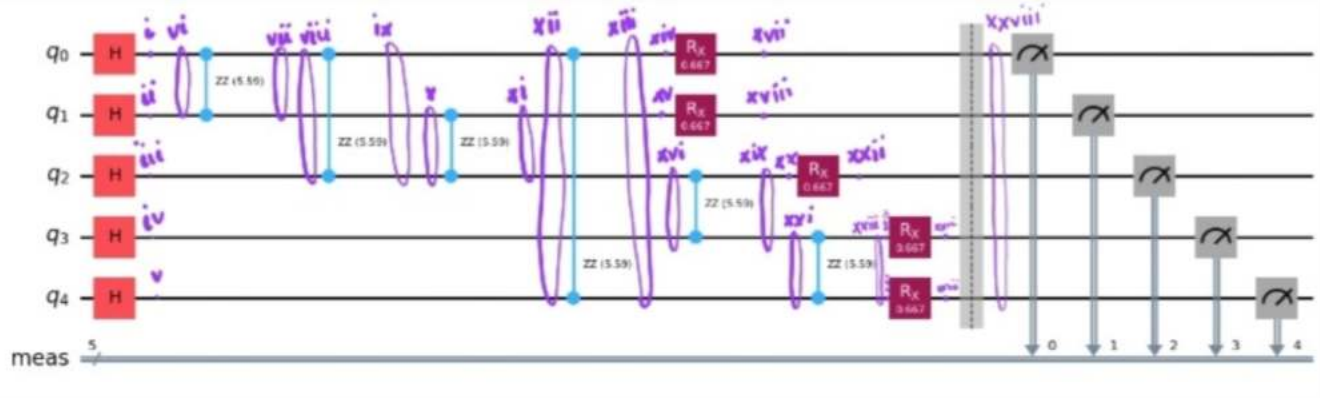
$$XIII = \frac{1}{4\sqrt{2}} \begin{bmatrix} e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \\ 1 \\ e^{i(5.59)} \end{bmatrix}$$



$$XiV = \frac{1}{4\sqrt{2}} \begin{bmatrix} e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \end{bmatrix}$$

$$XV = \frac{1}{4\sqrt{2}} \begin{bmatrix} e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \end{bmatrix}$$

$$XVi = \frac{1}{4\sqrt{2}} \begin{bmatrix} e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ e^{-i(11.18)} \\ e^{-i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \\ | \\ e^{i(5.59)} \end{bmatrix}$$

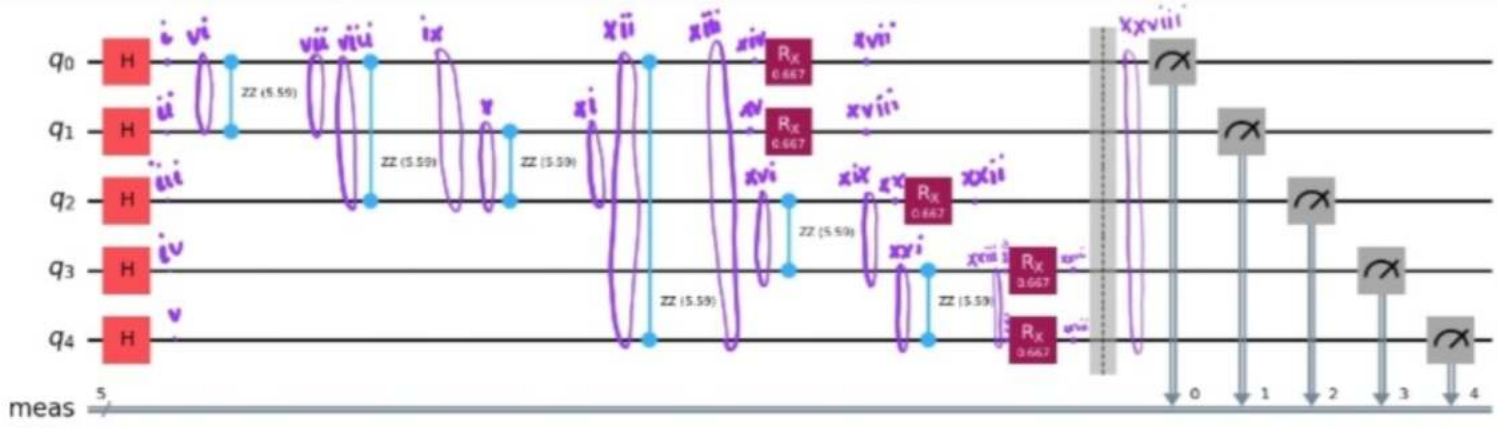


$$XVII = R_x(0.667) \otimes XIV$$

$$\begin{bmatrix}
0.137466 \times e^{i1.056615} \\
0.208814 \times e^{i0.478565} \\
0.137466 \times e^{i1.056615} \\
0.208814 \times e^{i0.478565} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i1.056615} \\
0.208814 \times e^{i0.478565} \\
0.137466 \times e^{i1.056615} \\
0.208814 \times e^{i0.478565} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006} \\
0.137466 \times e^{i-0.329756} \\
0.208814 \times e^{i-0.908006}
\end{bmatrix}$$

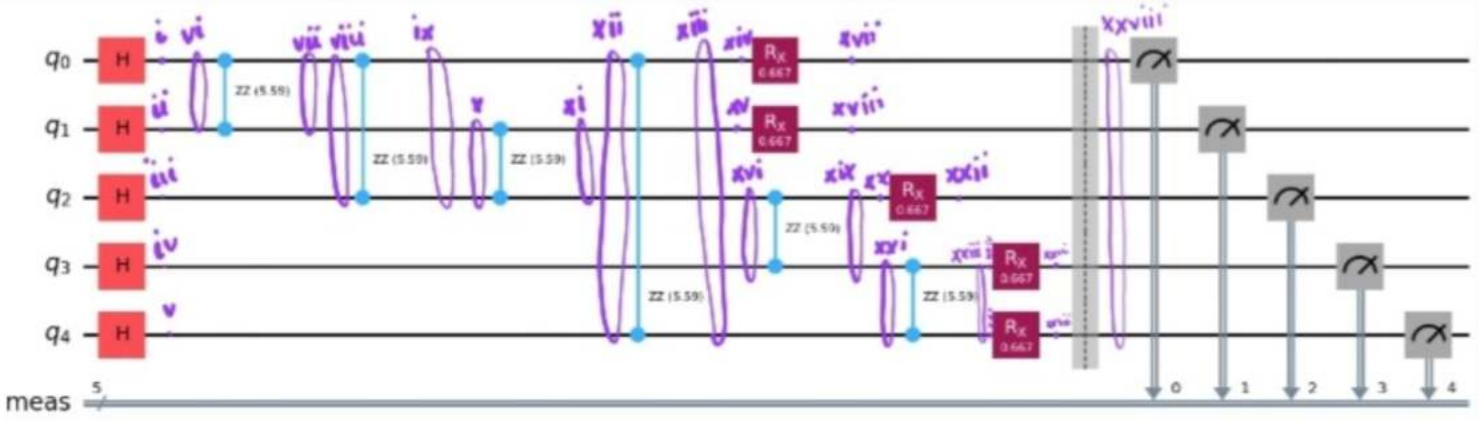
$$XVIII = R_x \otimes XV$$

$$\begin{bmatrix}
0.137466 \times e^{i0.723115} \\
0.208814 \times e^{i0.N4865} \\
0.137466 \times e^{i0.723115} \\
0.208814 \times e^{i0.N4865} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i0.723115} \\
0.208814 \times e^{i0.N4865} \\
0.137466 \times e^{i0.723115} \\
0.208814 \times e^{i0.N4865} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506} \\
0.137466 \times e^{i-0.662256} \\
0.208814 \times e^{i-1.241506}
\end{bmatrix}$$



$$XiX = \begin{bmatrix}
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494}
\end{bmatrix}$$

$$XX = \begin{bmatrix}
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.1317744} \\
0.208814 \times e^{i2.553494}
\end{bmatrix}$$

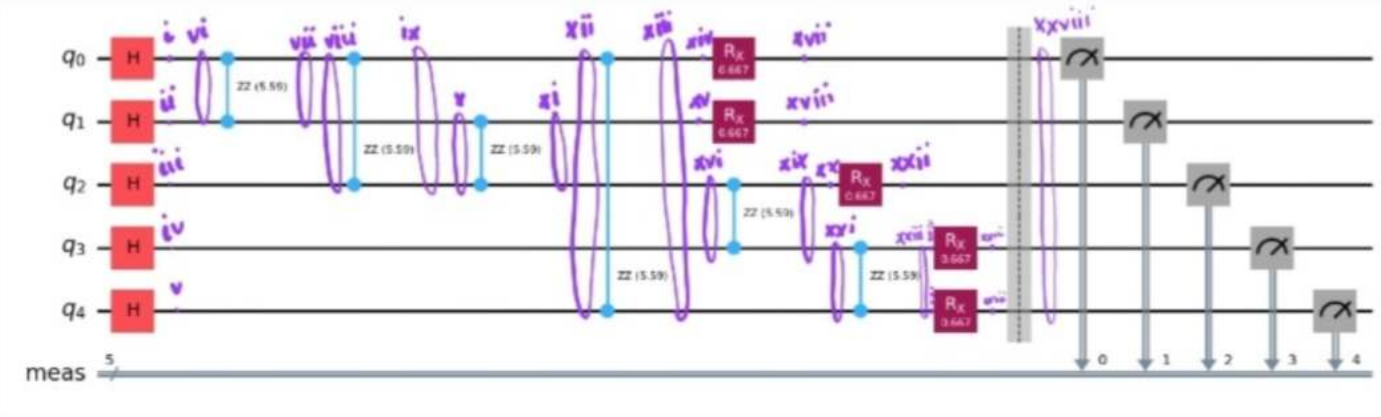


yxi =

$$
\begin{bmatrix}
0.137466 \times e^{i-2.67188} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i-2.671885} \\
0.208814 \times e^{i-2.650135} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494} \\
0.137466 \times e^{i2.131744} \\
0.208814 \times e^{i2.553494}
\end{bmatrix}
$$

XXii =

$$
\begin{bmatrix}
0.106897 \times e^{i-2.401641} \\
0.162379 \times e^{i-2.979891} \\
0.106897 \times e^{i-2.401641} \\
0.162379 \times e^{i-2.979891} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-2.401641} \\
0.162379 \times e^{i-2.979891} \\
0.106897 \times e^{i-2.401641} \\
0.162379 \times e^{i-2.979891} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076} \\
0.106897 \times e^{i-3.090826} \\
0.162379 \times e^{i-3.669076}
\end{bmatrix}
$$

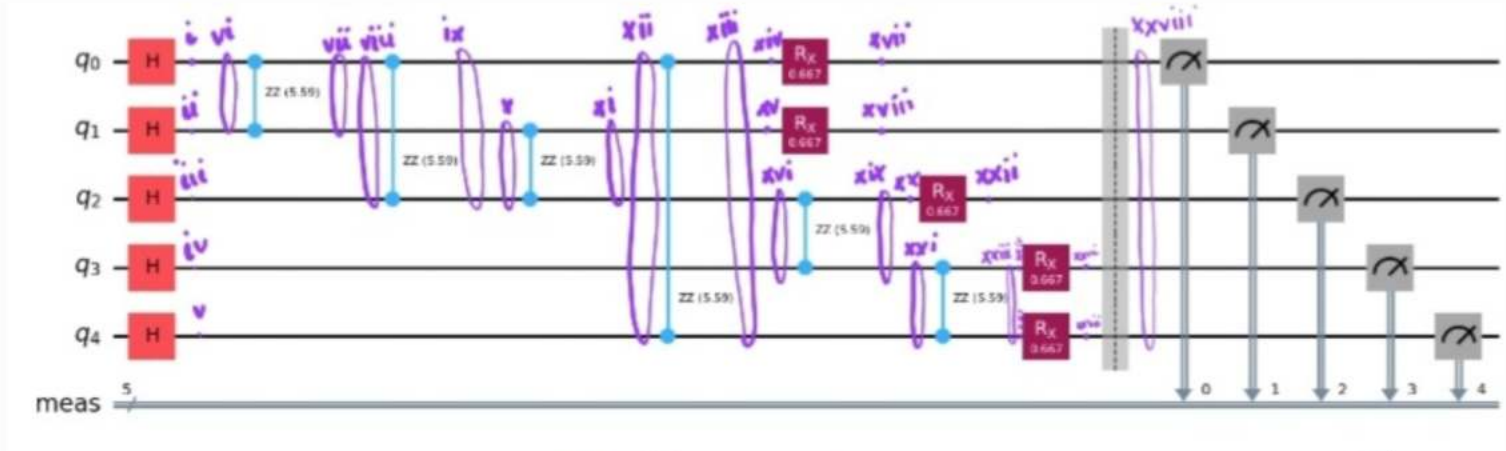


XXIII =

$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$

XXXIV =

$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$
$0.162379 \times e^{i\,0.508295}$
$0.106897 \times e^{i\,1.086545}$

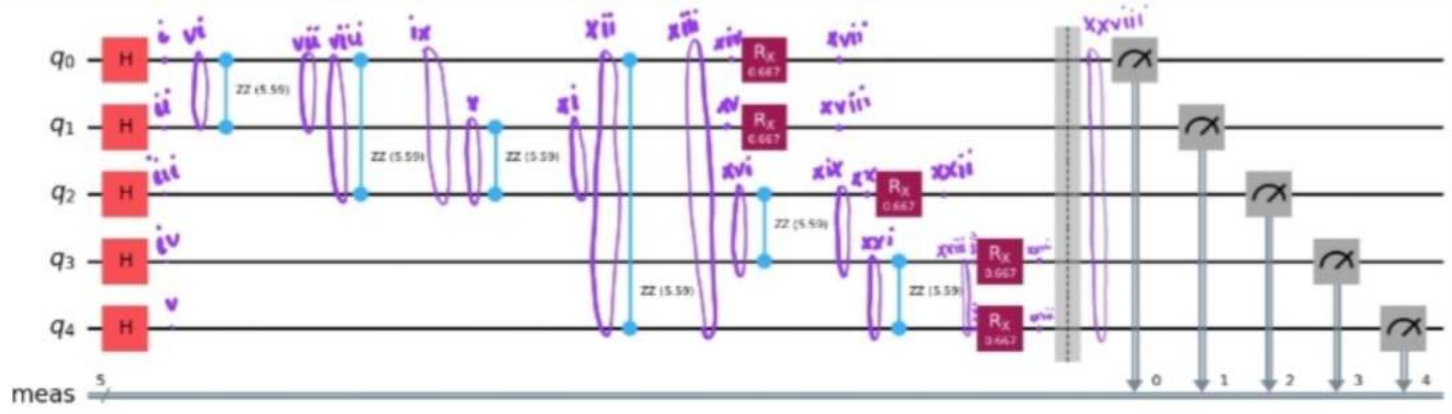


XXV =

$$
\begin{bmatrix}
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545} \\
0.162379 \times e^{i0.508295} \\
0.106897 \times e^{i1.086545}
\end{bmatrix}
$$

XXVI =

$$
\begin{bmatrix}
0.052606 \times e^{i0.783961} \\
0.079910 \times e^{i0.205711} \\
0.052606 \times e^{i0.783961} \\
0.079910 \times e^{i0.205711} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.052606 \times e^{i0.783961} \\
0.079910 \times e^{i0.205711} \\
0.052606 \times e^{i0.783961} \\
0.079910 \times e^{i0.205711} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537} \\
0.153409 \times e^{i0.279713} \\
0.092507 \times e^{i0.298537}
\end{bmatrix}
$$



XXVII = $\begin{bmatrix} 0.083126 \times e^{i0.756789} \\ 0.126270 \times e^{i0.178539} \\ 0.083126 \times e^{i0.756789} \\ 0.126270 \times e^{i0.178539} \\ 0.126270 \times e^{i0.18540} \\ 0.083126 \times e^{i0.756790} \end{bmatrix}$ repeated 16 times

XXVIII = after last gate, all qubit went under final gate.

Therefore it is same as XXVII.

and in single run, we would see one bit-string like eg: 01011 or 10101. Strings with 1 at last bit are more likely than ones ending with 0.

$\begin{bmatrix} 0.083126 \times e^{i0.756789} \\ 0.126270 \times e^{i0.178539} \\ 0.083126 \times e^{i0.756789} \\ 0.126270 \times e^{i0.178539} \\ 0.126270 \times e^{i0.18540} \\ 0.083126 \times e^{i0.756790} \end{bmatrix}$ → 00000, 00001, 00010, 00011, 00100, 00101, 00110, 00111, 01000, 01001, 01010, 01011, 01100, 01101, 01110, 01111, 10000, 10001, 10010, 10011, 10100, 10101, 10110, 10111, 11000, 11001, 11010, 11011, 11100, 11101, 11110, 11111

with measure: Statevector is 01010